



# Space Science

*Marshall Space Flight Center CDDF Success Story Number 4*

## **Laboratory for Extraterrestrial Dust Studies**

The work supported by this MSFC/CDDF relates to the study of tiny, micron-sized, single dust particles and how they interact with a beam of electrons. Dust grains are naturally occurring and are found in all regions of space and time—from high stratospheric clouds on Earth to the rings around Saturn; from comet tails to stellar nebula; and from the remnants of dying stars to the early solar system and planetary development. Dust grains are electrically charged by virtue of being exposed to UV light and being bombarded by charged particles such as electrons and ions. An assembly of these charged dust grains is commonly referred to as a “dusty plasma.” The charge on these grains significantly influences how matter and charge are distributed in space. The infrared background radiation in space is dominated by the presence of dusty plasma. How individual grains are charged has been modeled and studied, but not directly measured.

The establishment of the Laboratory for Extraterrestrial Dust Studies (LEDS), aka Dusty Plasma Laboratory, with this CDDF has allowed researchers at MSFC to study for the first time, individual micron-sized dust grains and associated charging effects. An innovative technique known as an electrodynamic balance, or quadrupole trap, is used to levitate a single dust particle in an alternating electric field. Using light scattering, particle motion and balance voltages, the size, mass and number of electric charges residing on the particle is determined. The results of this experiment will test several fundamental theories and models for the first time. This effort is still evolving and initial results are soon to be forthcoming.

The future looks promising for LEDS as a result of this MSFC/CDDF project. This effort has given rise to a new working group in the Space Sciences Laboratory. This group is interdisciplinary, and crosses over traditional branch lines within the MSFC organizational structure. The emphasis of this new group will be directed to the Origins program that NASA Headquarters is promoting. It will be comprised of experimental, data analysis and theoretical efforts. The University of Alabama is also involved in this study as graduate students have benefited by using this experiment as the basis for their thesis work.